Investigation and Demonstration of a Rich Combustor Cold Start Device for Alcohol Fueled Engines

Subcontractor

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Subcontract Number

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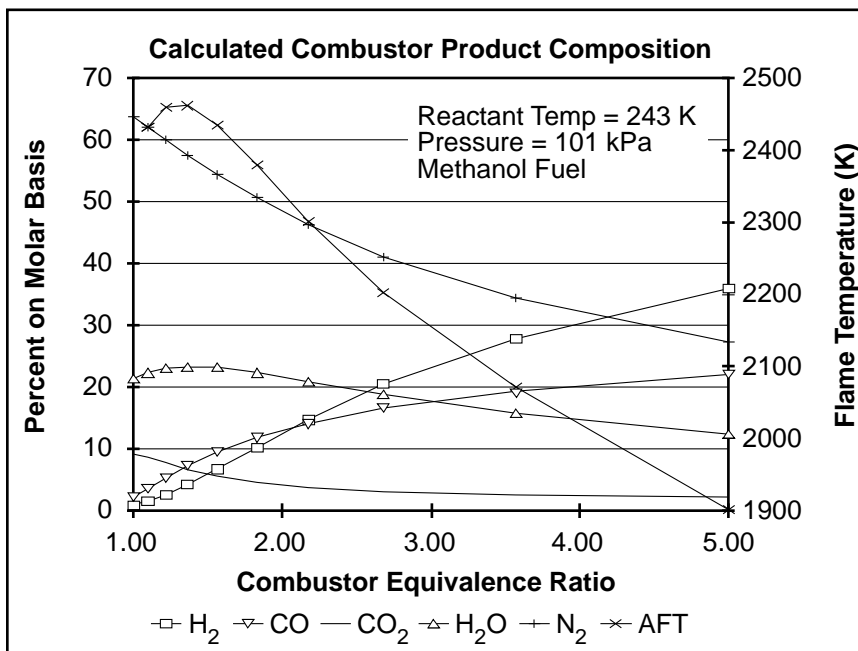
Performance Period

1/95–12/96

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Objective

To design, fabricate, and demonstrate a rich combustor device intended to facilitate cold starting of alcohol-fueled spark ignition engines.

Calculated Combustor Product Composition

Reactant Temp = 243 K
Pressure = 101 kPa
Methanol Fuel

Percent on Molar Basis / Combustor Equivalence Ratio / Flame Temperature (K)

H_2 ▽ CO — CO_2 △ H_2O + N_2 ✳ AFT

Approach

The University of Tennessee has previously conducted proof-of-concept tests that have shown a methanol-fueled spark ignition engine can be started with gases produced by a rich combustor device fueled with methanol. The gases generated by the rich combustor device produce the noncondensable flammable gases hydrogen and carbon monoxide that serve to start the engine at temperatures as low as -30°C.

Accomplishments

Two tools have been developed for use in the design of the combustor. One predicts the composition of the product gas stream leaving the rich combustor; the other calculates the fuel requirements of the engine as a function of the vehicle operating condition. The Federal Urban Driving Cycle will be used for cold start and drive-away vehicle operating requirements. Design work on the rich combustor has started.
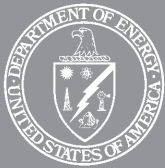
Future Direction

Work will continue on designing and fabricating a proto-type combustor. Following the fabrication we will bench test the prototype, then install it on a test vehicle. Once the prototype is operating on the vehicle, emission and fuel economy tests will be run.

Publications

None to date.

Calculated Engine Output

Methanol Fuel
Equivalence Ratio = 1
Ambient Temp = 243 K
2.8 L Corsica Engine

(Graph: Brake Power (hp) vs. Intake Manifold Pressure (atm))

—— 3000 rpm   ▽ 2000 rpm   ☐ 1000 rpm

Calculated Engine Output

Methanol Fueled Rich Combustor
Products Cooled to 243 K
Combustor Equivalence Ratio=2
Engine Equivalence Ratio = 1
Ambient Temp = 243 K
2.8 L Corsica Engine

(Graph: Brake Power (hp) vs. Intake Manifold Pressure (atm))

—— 3000 rpm   ▽ 2000 rpm   ☐ 1000 rpm